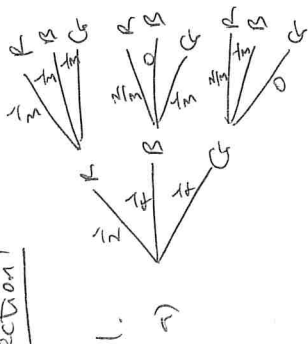


Statistics 12 - Hypothesis Testing - Solutions

Section 1



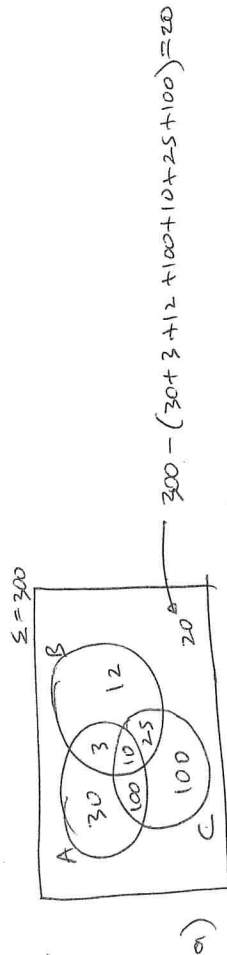
1. a)
$$P(B, G) + P(G, B)$$

$$= \frac{1}{2} \times \frac{1}{2} + \frac{1}{2} \times \frac{1}{2}$$

$$= \frac{1}{2} + \frac{1}{2}$$

$$= \frac{1}{6}$$

2.



a)
$$P(C) = \frac{100 + 100 + 10 + 25}{300} = \frac{235}{300} = \frac{47}{60}$$

b)
$$P(A) = \frac{20}{300} = \frac{1}{15}$$

Section 2

1. a) $H_0: p = 0.68$ ✓

$H_1: p \neq 0.68$ ✓

b) 2-tailed test ✓

2.

a) $X \sim \text{Bin}(10, 0.25)$

$P(X \geq 5) = 1 - P(X \leq 4) = 1 - 0.9219 = 0.0781$ ✓

$0.0781 > 0.05 \Rightarrow$ Accept H_0 , Reject H_1 ✓

b) $X \sim \text{Bin}(10, 0.4)$

$P(X \leq 1) = 0.0464$ ✓

$0.0464 < 0.05 \Rightarrow$ Accept H_1 , Reject H_0 ✓ (4)

3. $X = 10$ days ahead it rains in Combourne

$X \sim \text{Bin}(20, 0.3)$

$H_0: p = 0.3$ ✓

$H_1: p > 0.3$ ✓

$P(X \geq 10) = 1 - P(X \leq 9) = 1 - 0.9520 = 0.0480$ ✓

$0.0480 < 0.05 \Rightarrow$ Accept H_1 , Reject H_0 ✓

i.e. from the sample there is sufficient evidence at the 5% level to support Mitchell's view that it rained on more than 30% of days in Combourne in 2015 ✓ (4)

4. $X = 10$ feet/min seeds that produce a plant

$X \sim \text{Bin}(20, 0.45)$

$H_0: p = 0.45$ ✓

$H_1: p < 0.45$ ✓

$P(X \leq 3) = 0.0349$ ✓

$0.0349 < 0.01 \Rightarrow$ Accept H_1 , Reject H_0 ✓

i.e. from the sample there is sufficient evidence at the 1% level to support the gardeners view that she will be less successful with her petunia plants than usual. (4)

5. $X =$ no. female kittens

$X \sim \text{Bin}(20, 0.5)$

$H_0: p = 0.5$

$H_1: p \neq 0.5$

would expect $20 \times 0.5 = 10$ female kittens. Since there were only 7 females we only need to check $P(X \leq 7)$

S.Y., 2-tail $\Rightarrow 0.025$

$P(X \leq 7) = 0.1316 > 0.025 \Rightarrow$ Accept H_0 , Reject H_1 .

i.e. from the sample there is insufficient evidence at the 5% level to support the biologist's predictions that the number of males & females will not be equal. (5)

6. $X =$ no. tails

$X \sim \text{Bin}(50, 0.6)$

$H_0: p = 0.6$

$H_1: p \neq 0.6$

would expect $50 \times 0.6 = 30$ tails. Since there were

37 tails, we only need to check $P(X \geq 37)$

S.Y., 2-tail $\Rightarrow 0.025$

$P(X \geq 37) = 1 - P(X \leq 36) = 1 - 0.972 = 0.028 > 0.025$

\Rightarrow Accept H_0 , Reject H_1 .

i.e. from the sample there is insufficient evidence at the 5% level to support Charles' suspicions that the coin has been made incorrectly. (5)

Total = 25

Section 3

1. $X =$ no. veg meals ordered

$X \sim \text{Bin}(20, 0.25)$

$H_0: p = 0.25$

$H_1: p < 0.25$

$P(X \leq 2) = 0.0912$

If test at 10% level would conclude Accept H_1 because $0.0912 < 0.1$. If used on smaller significance would conclude Accept $H_0 \Rightarrow$ Abdul should use 10% test.